

## **Developing Key Energy Indicators**

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## Introduction

In June of 2007, an inter-office team of EIA analysts and statisticians was chartered to identify a set of approximately 12 statistics or indicators to be designated Key Energy Indicators. The selected set of indicators will appear together, possibly in a prominent location, on the EIA website for the purposes of

- a) providing a quick, easily accessible *overview*—the “big picture”—of the current US energy situation;
- b) highlighting, for the media and the interested public, important *changes* in the energy situation; and
- c) increasing the accessibility of some of EIA’s most broadly relevant products.

The key indicators will cover a wide range of energy topics, such as consumption, production, source diversity, use of renewable fuels, and environmental impacts. In this paper, we describe the inter-office team’s progress to date in identifying indicators and discuss some related issues the team has considered. We then present the team’s preliminary set of selected energy indicators.

## 1. Background

### *1.1. The Growing Popularity of Indicator Collections*

Many organizations throughout the world compile and publish collections of indicators. International organizations such as the United Nations, the Organization for Economic Co-operation and Development (OECD), and the International Atomic Energy Association (IAEA) have for decades maintained their own indicator sets for international comparisons. The European Union (EU) established a collection of structural indicators to be harmonized across all EU countries. The EU maintains a “long list” of over 130 structural indicators as well as a “short list” of 14 key indicators. The EU’s long list of structural indicators, while not specifically focused on energy issues, includes five indicators related to the gasoline and electricity markets, as well as an indicator of the energy intensity of the economy (consumption divided by GDP). The energy intensity indicator also appears on the EU short list.

Some indicator collections focused specifically on energy issues are already available on the internet or in print. The International Energy Agency (IEA), a forum for coordinating the energy policies of 26 member countries, publishes a large collection of petroleum-related indicators, as well as indicators on many other energy-related topics. The IEA recently published a book entitled *Energy Use in the New Millennium: Trends in IEA Countries*, which provides a vast array of energy indicators at national and international levels. The United Nations publishes an Energy Statistics Yearbook that provides thousands of data elements on the production, consumption, trade, and storage of fuels worldwide.

During the past several years, the National Academy of Sciences has been working, in collaboration with government agencies, to establish and maintain a “State of the USA”

website presenting a collection of 30 key national indicators.<sup>1</sup> The Key Energy Indicators project may eventually provide energy indicators to be linked to the Key National Indicators presented on the site. Comparing energy statistics across countries is not the primary goal of EIA's Key Energy Indicator project, however, so the indicators selected need not be part of a harmonized international indicator system.

### *1.2. Indicator Collections Presented by Federal Statistical Agencies*

Statistical agencies often highlight their most closely watched products in special displays on their internet home pages. The Bureau of Labor Statistics (BLS), the Bureau of the Census (BOC), and the Bureau of Transportation Statistics (BTS) provide three interesting examples. Each display is based on a different presentation approach and reflects an emphasis unique to the Department housing the statistical agency. All three, however, give users instant access to the agency's key indicators at the national level of aggregation. Moreover, each provides drill-down capabilities giving users two- or three-click access to metadata, associated statistics at lower levels of aggregation, and historical series.

The BLS provides the display of its flagship economic indicators simulated in Figure 1.



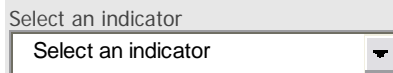
**Figure 1. BLS Home Page Display of Current BLS Flagship Indicators**

As Figure 1 shows, the BLS indicators cover the broad economic areas of unemployment, job creation, price inflation/deflation (at retail, wholesale, and import levels), compensation inflation/deflation, and productivity. These statistics reflect the Labor Department's emphasis on factors that affect working people. Clicking on the name of the indicator takes the user to geographically detailed data and associated metadata. To access the historical series, users need only click on the dinosaur below the indicator name.

<sup>1</sup> For details on the development of the Key National Indicators, see <http://www.gao.gov/np/usa/kni.pdf>.

Similarly the Bureau of the Census (BOC) home page gives users quick access to fourteen of the BOC's most closely watched products. The BOC's page uses a drop-down menu to let users pick an indicator or view all fourteen of them in a virtual economics "briefing room."

#### Economic Indicators



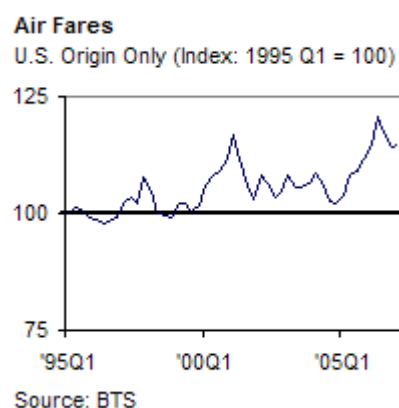
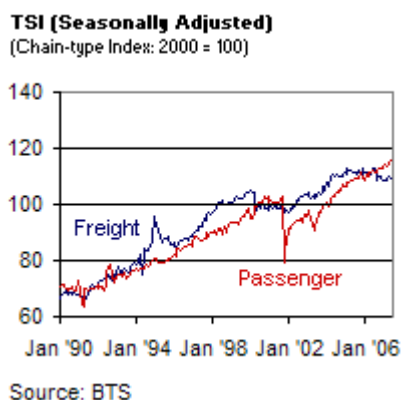
**Figure 2. BOC Home Page Drop-Down Menu for Economic Indicators**

The list provides a choice between the following topics:

- Construction Spending
- New Orders for Durable Goods
- Homeownership
- Housing Starts
- Housing Vacancies
- Manufacturers' New Orders
- Manufacturers' Profits
- Monthly Retail Trade
- Monthly Wholesale Trade
- New Home Sales
- Quarterly Services Survey
- Retail Profits
- Total Business Sales
- Trade Balance

As expected, the BOC indicator list reflects the Department of Commerce emphasis on manufacturing, business volumes, sales, and profits.

The Bureau of Transportation Statistics (BTS) employs a graphical approach in its home page indicator display, showing line charts of BTS' two index series, the Transportation Services Index, and the Air Travel Price Index. Users can click on either graph to go to the most recent press release for the index displayed. Users who drill down further in the Air Travel Price Index metadata will quickly find city-level index series and technical notes on the estimation methods employed.



**Figure 3. BTS Home Page Graphical Display of Two Index Series**

In summary, the three home page indicator displays we've reviewed all have the following features in common:

- a) All indicators are current and are shown at their highest levels of aggregation, with drill-down capabilities to disaggregate data, historical series, and metadata.
- b) Each agency displays its own products, and each collection of indicators reflects its own departmental emphasis.
- c) All indicators are related to economics.

In addition to these common elements, however, we see wide variation in the approaches to presenting the indicators.

## **2. Parameters of the Key Energy Indicators Project**

The EIA Interoffice Issues Group (IIG), comprising managers and senior staff from all EIA offices, chartered the Key Energy Indicators Subgroup (KEIS) to develop recommendations for a set of key energy indicators. The IIG agreed that these indicators would not be intended to provide detailed data for industry analysts. Rather, the target users would be government policy makers, the media, and the interested public. The indicators were to be current, data based (i.e., not forecasts dependent on model assumptions), and broadly focused, ideally covering all of the following areas:

- a. Energy economics (e.g., prices)
- b. Energy production, consumption, and source diversity
- c. Use of renewable energy sources
- d. Environmental impacts of energy use

The aggregation levels of the indicators were also considered, and the IIG agreed that at least some indicators should be aggregates cutting across the various energy sources, while others could be fuel-specific (e.g., crude oil prices, natural gas storage volumes). Indicators could be statistics already published by EIA or new indicators that EIA could research, develop, and eventually publish. The former indicators might simply receive new emphasis, or they might be presented in a new type of graphical display.

## **3. Issues in Selecting Key Energy Indicators**

The Key Energy Indicators Subgroup (KEIS) comprises members from the following EIA offices:

- Office of Oil and Gas
- Office of Coal, Nuclear energy, Electricity, and Alternative Fuels
- Office of Energy Marketing and End Use
- Statistics and Methods Group
- National Energy Information Center
- Office of Integrated Analysis and Forecasting

The KEIS began by brainstorming for interesting indicators, initially developing a list of over 100 potential key indicators. In narrowing down the list, the group discussed and

reached tentative decisions on several issues related to the indicators and their presentation by EIA.

### 3.1. Wholesale Energy Market Prices

The original KEIS “long list” of indicators included some well-known energy market price quotes such as the West Texas Intermediate (WTI) Cushing crude oil spot price<sup>2</sup> and the Henry Hub natural gas spot price. After some in-depth discussion of these price quotes, the group decided that, in general, wholesale energy market prices should not be included in the list of Key Energy Indicators because

- a) they can change from minute to minute, making them difficult to maintain online;
- b) customers who want these prices usually go to the trade websites (e.g., Bloomberg.com) to obtain them rather than to the EIA site; and
- c) the significance of these prices is not immediately intuitive to our target audience for the Key Energy Indicators. (The target audience is the interested public, not industry analysts or commodity traders.)

The only exception was the daily WTI Cushing crude oil spot price that EIA usually maintains on its home page. This is not the “up-to-the-minute” WTI. Rather, it is a daily settlement price provided to EIA by Bloomberg, and EIA publishes it with a lag. The National Energy Information Center gets many requests for this price quote, and the group decided that the indicator list would be incomplete without a wholesale crude oil price.

### 3.2. Principal Economic Indicators

The Office of Management and Budget (OMB) confers the designation of Principal Economic Indicator (PEI) on some data products and news releases produced by federal agencies. OMB maintains a schedule of release times for PEI’s and requires stringent adherence to pre-release embargo rules and exact release times. The collections of economic indicators prominently displayed on the BLS and BOC home pages correspond tightly<sup>3</sup> to the collections of officially designated PEI’s that these agencies produce. The KEIS therefore considered the option of automatically including all PEI’s produced by EIA among the Key Energy Indicators.

To date, EIA has submitted only one of its products to OMB for PEI designation. EIA’s weekly estimate of the volume of natural gas in underground storage was designated a PEI in September, 2007. The KEIS decided to include this indicator among the Key Energy Indicator and to consider all indicators that EIA management submits for PEI designation in the future as strong candidates for inclusion.

### 3.3. Frequency, Aggregation Levels, and Drill-down Capabilities

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<sup>2</sup> The WTI Cushing spot price is the price at which crude oil is traded in the domestic spot market at Cushing, Oklahoma.

<sup>3</sup> The correspondence is not exact, because PEI’s need not be individual indicators. The monthly BLS “Employment Situation” news release, for example, is a designated PEI. In this release, BLS publishes new estimates of the unemployment rate and the number of jobs created in business establishments. Both of these estimates appear in the list of “Latest Numbers” on the BLS home page.

Several of the indicators on the KEIS “long list” represented broad sets of statistics that EIA publishes at various frequencies (monthly, annually, etc.) and at various level of aggregation (national, regional, state, etc.). For some of these broad sets, the KEIS reached immediate consensus on including one indicator from the set among the Key Indicators to be presented “up front,” with drill-down capabilities to similar indicators at other frequencies and levels of aggregation. The difficult decision sometimes came in determining *which* indicator in the set was most important and should be presented as part of the short, up-front list.

One indicator set that almost immediately gained the group’s acceptance, for example, was electricity generation (BTU’s) by fuel source. EIA publishes both monthly and annual estimates of electricity generation, disaggregated by fuel source, geographic area, and other variables. The most recently available monthly estimates are more current than the annual estimates for the previous year. The monthly estimates, however, are subject to seasonal variation, and EIA currently has no plans to produce seasonally adjusted estimates of electricity generation. Other problematic examples include residential electricity prices (should the up-front data be national or regional?) and average regular gasoline prices (are the prices or the changes in price more important to users?). Frequency and aggregation levels for some indicators are still under discussion.

#### 3.4. Should All Indicators be EIA Products?

The indicator lists presented by BLS, BOC, and BTS comprise only indicators produced by the publishing agencies. The KEIS considered limiting the Key Energy Indicators list to EIA products. Ultimately, however, the goal of presenting the “big picture” of the energy situation took precedence over the goal of highlighting EIA’s flagship products. The group agreed that, although the indicator set should consist *primarily* of EIA products, exceptions could be made where warranted. Crude oil prices, for example, were too important to omit, though they came from external sources.

#### 3.5. Usability Testing and Metadata

The KEIS also discussed methods of obtaining both internal and external feedback on the usefulness of the indicator list. The group’s plan for obtaining and incorporating internal EIA feedback includes presentations to EIA managers as well as an e-mail feedback opportunity for interested staff.

For external users, KEIS members agreed that the quality of the metadata that EIA provided with the indicators would substantially influence their usefulness. External feedback on the KEIS indicator selections will have to be obtained together with feedback on the metadata EIA maintains for the indicators. New projects may be initiated to help address the challenges EIA currently faces with regard to documentation and variance estimation.

One important project, for example, might be aimed at developing standard errors for the week-to-week and year-to-year changes in regular gasoline prices that appear on the EIA home page. The average gasoline prices are estimated from a sample survey, and EIA currently cannot determine the statistical significance of the period-to-period changes,

because no standard errors are available for the estimates of change. Many other important EIA statistics lack error measures and/or clear, accessible documentation of the data collection and estimation methods used. The Key Energy Indicators list may serve as a tool for prioritizing the metadata projects to be taken up in the future.

#### **4. Recommended List of Key Energy Indicators**

The recommended list of energy indicators emerged by consensus after two months of wide ranging discussion. In this section, we discuss the nature of the selected indicators and some of the reasons the KEIS selected them. Although the reasons vary for the different indicators, the group viewed each of these indicators as contributing an important piece of the “big picture” of the U.S. energy situation. The indicators fall into three broad categories: (a) energy price indicators; (b) indicators of supply, consumption, and source diversity; and (c) indicators of the energy and carbon intensity of the economy.

##### a) Energy Price Indicators

###### *1, 2. Average retail prices for regular gasoline price and on highway diesel fuel (weekly)*

Transportation accounts for 25% to 30% of US energy consumption. The two most important transportation fuels are (i) regular motor gasoline used for private automobile travel, and (ii) diesel fuel used for commercial trucking. Each Monday at 5:00 p.m., EIA releases average price estimates for regular gasoline and on-highway diesel fuel. Gasoline prices are estimated based on data collected on Form EIA-878. On-highway diesel price are based on data collected on Form EIA-888. Both price surveys cover all regions of the US.

*Reasons for selecting these indicators:* Gasoline represents a major consumer energy expenditure. Due to the importance of these fuel prices in the U.S. economy, the weekly gasoline and diesel price estimates are two of EIA’s most closely watched products.

###### *3. Residential price of electricity by Census region (monthly, annual)*

EIA currently publishes both monthly and annual average retail electricity prices for residential customers, at the national, regional, and state levels. The prices are estimated using data collected through Forms EIA-861 and EIA-826. Average monthly prices are subject to seasonal, as well as regional, variation.

*Reasons for selecting this indicator:* The cost of electricity is a significant part of many household budgets in the U.S., especially those households using it for both heating and cooling.

###### *4. Residential price of natural gas (monthly, annual)*



EIA currently publishes both monthly and annual average retail prices for residential natural gas. Because other heating fuels predominate in some parts of the U.S. (e.g., distillate fuel oil in the northeast, propane in some rural areas), the KEIS recommends that the indicator site allow drill-down capabilities to price data for other widely-used heating fuels.

*Reasons for selecting this indicator:* According to the BOC's American Community Survey, natural gas is the most popular home heating fuel in the U.S. Changes in residential natural gas prices therefore impact the energy costs of large numbers of consumers.

5. *Wholesale crude oil price (daily)*

Each day, EIA publishes a West Texas Intermediate (WTI) Cushing crude spot price, representing a settlement price for domestic crude from two days prior to the publishing date. Although the WTI Cushing spot crude oil price is not an EIA product, it is a very important indicator of future energy prices.

*Reasons for selecting this indicator:* Because products derived from crude oil provide approximately 40% of the energy consumed in the U.S., wholesale crude oil prices have a substantial impact on the prices Americans pay for energy.

6. *Energy Consumer Price Index (ECPI)*

Among the new measures that the KEIS considered for possible development by EIA was a consumer price index for energy. The BLS CPI incorporates an energy component, but it is volatile due to small sample sizes and outdated weights, as well as due to actual volatility in energy markets. Using its own energy price and consumption data, EIA may construct a new index for energy prices.

*Reasons for selecting this indicator:* The ECPI would track changes in overall energy prices over time. Larger sample sizes and more up-to-date weights would likely render the EIA index superior to the BLS index as a measure of energy price inflation/deflation.

b) Indicators of Energy Supply, Consumption, and Source Diversity

7, 8. *U.S. energy (BTU's) production and consumption by fuel type*

While fossil fuels account for about 85% of the energy production in the U.S., price, supply, and environmental concerns will encourage the development of alternative sources in the future. EIA's *Annual Energy Review* (AER) provides data on the percentages of energy production for fossil fuel and alternative fuels. These percentages give the interested user information on trends in the market penetration of various alternative fuels. Similarly, AER estimates of U.S. energy consumption by fuel type reveal trends in consumer preferences for different fuel sources. The consumption estimates incorporate consumption totals for imported fuels as well as domestically produced fuels.

*Reasons for selecting these indicators:* These indicators will answer the simple question, “How much energy does America make and use?” Future technological advances will eventually change the fuel mix consumed. EIA will be prepared to tell the story with numbers in an easy-to-find and easy-to-understand format.

9. *Electricity generation by fuel source (monthly, annual)*

The electricity consumed in the U.S. comes from several sources, but the fossil fuels—coal, petroleum, and natural gas—contribute about 70% of the total. EIA publishes data on the fuel sources for electricity each month in the *Electric Power Monthly* and once a year in the *Electric Power Annual*. The data sources are the Forms EIA-906 and EIA-920 (these forms will soon be merged to form the EIA-923).

*Reasons for selecting this indicator:* The mix of renewable energy sources and fossil fuels used for electricity generation has major implications for energy prices, green house gas emissions, and energy dependence. Moreover, many consumers are unaware of the current fuel mix, e.g., of the importance of coal in U.S. electricity generation.

10. *Net petroleum inputs by source country (monthly)*

For decades the U.S. has relied to some degree on petroleum imports to meet its energy needs. Currently, about 60% of the petroleum consumed in the U.S. is imported. EIA publishes monthly estimates of petroleum imports (based on data from form EIA-814) and domestic production.

*Reasons for selecting this indicator:* The set of countries exporting petroleum to the U.S. and the relative amounts that they input impact the affordability, diversity, and security of the U.S. energy supply.

11. *Volume of natural gas in underground storage (weekly)*

Natural gas, a popular fuel used for heating, electricity generation, and some manufacturing processes (e.g., fertilizer production), can be stored underground when not immediately used.<sup>4</sup> Based on data collected on Form EIA-912, EIA estimates of the volume of natural gas in underground storage in the United States on a weekly basis.

Every Thursday at 10:30 a.m., EIA’s release of its weekly estimate of the volume of natural gas in underground storage is followed with interest by natural gas traders and producers. Traders use the storage figure as a key piece of data for forecasting natural gas prices. A low volume in storage is a signal to producers to drill for more gas to meet potential future demand, while a high volume is a signal to decrease drilling.

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<sup>4</sup> Underground storage does not affect the quality of natural gas.

*Reasons for selecting this indicator:* The volume of natural gas in storage affects future natural gas prices. OMB recently designated the weekly EIA release of this indicator as a Principal Economic Indicator.

c) Indicators of the Energy and Carbon Intensity of the Economy

*12. Energy Consumption (BTU's) / GDP (annual)*

The ratio of energy consumed (in British thermal units, or BTU's) to GDP is known as the "energy intensity of the economy." EIA's Office of Integrated Analysis and Forecasting reports this ratio annually. The ratio form makes it easier to differentiate reductions in energy consumption that result from efficiency gains from reductions that result from decreases in the level of economic activity (as measured by GDP).

The energy intensity of the economy appears on the EU's "short list" of structural indicators. Because the measures in the numerator and denominator of this ratio are very general, approximate comparisons across countries may be interesting (given appropriate currency conversions), even though the ratios may not be computed in an internationally harmonized fashion.

*Reasons for selecting this indicator:* Reductions in this indicator are likely to reflect genuine gains in energy efficiency.

*13. CO<sub>2</sub> / GDP (annual)*

The ratio of carbon dioxide (CO<sub>2</sub>) emissions to Gross Domestic Product (GDP) is known as the "carbon intensity of the economy." EIA's Office of Integrated Analysis and Forecasting reports this ratio annually. The ratio form makes it easier to differentiate reductions in CO<sub>2</sub> emissions that result from environmentally friendlier energy production and consumption processes from reductions that result from decreases in the level of economic activity. CO<sub>2</sub> is a byproduct of consuming fossil fuels, and recent years have seen increased concern over its contribution to global warming.

*Reasons for selecting this indicator:* In the desire to secure reasonable energy supplies with minimal environmental damage, policy makers seek to reduce the carbon intensity of the economy.

**References**

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### Questions for the ASA Committee

- 1) Is it a good idea for EIA to develop a set of key energy indicators for the purposes described?
- 2) What *types* of indicators should be included in the set? What types should be excluded?
- 3) Are there particular indicators that should be added to or deleted from the set that the interoffice team has identified?
- 4) Should the most recent number always be published “up front”? For example, if we have both annual and monthly estimates, should the most recent monthly estimate appear on the initial list? (Some EIA monthly estimates are seasonal and are not currently adjusted for seasonality.)
- 5) What error measures should be published with each of the key indicators?